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Keeler et al.

[11] **4,295,012**

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[54] **SECRETARIAL SHIFT MECHANISM FOR AN ELECTRIC KEYBOARD**

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[51] **Int. Cl.**[3] **H01H 9/20**

[52] **U.S. Cl.** ..... **200/5 B**; 200/50 C; 400/276

[58] **Field of Search** ..... 400/479, 479.2, 276; 200/153 J, 330, 5 B, 50 C

[56] **References Cited**

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3,863,748	2/1975	Trezise	400/276

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Assistant Examiner—Morris Ginsburg
Attorney, Agent, or Firm—Glenn W. Bowen; Thomas W. Buckman

[57] **ABSTRACT**

A secretarial shift mechanism which includes two shift keyswitches and one shift lock keyswitch is disclosed. The two shift keyswitches have T-shaped actuating bars secured to their plungers. The shift lock and release keyswitch has a generally C-shaped wire spring retainer placed around its housing which is utilized to secure a hook on a latching finger on a ledge that is formed on the plunger of the shift lock keyswitch. The latching finger is secured to an elongated torsion bar which has a pair of arms at the ends of the bar that are bent toward the two shift keyswitches. The torsion bar is held at its ends against the frame that holds the keyswitches of the keyboard by clamping caps that project from the shift keyswitches and have grooves in them that receive the torsion bar therein. When the shift lock keyswitch is depressed, a hook on the latching finger that is secured at the torsion bar engages a ledge on the plunger of the shift lock keyswitch and holds it down. Depression of either of the shift keyswitches causes the T-bar on the keyswitch to engage the bent arms on the torsion bar, which in turn results in twisting of the torsion bar sufficiently to deflect the latching finger so the lock is off of the ledge which releases the shift lock keyswitch from its actuated condition.

8 Claims, 8 Drawing Figures

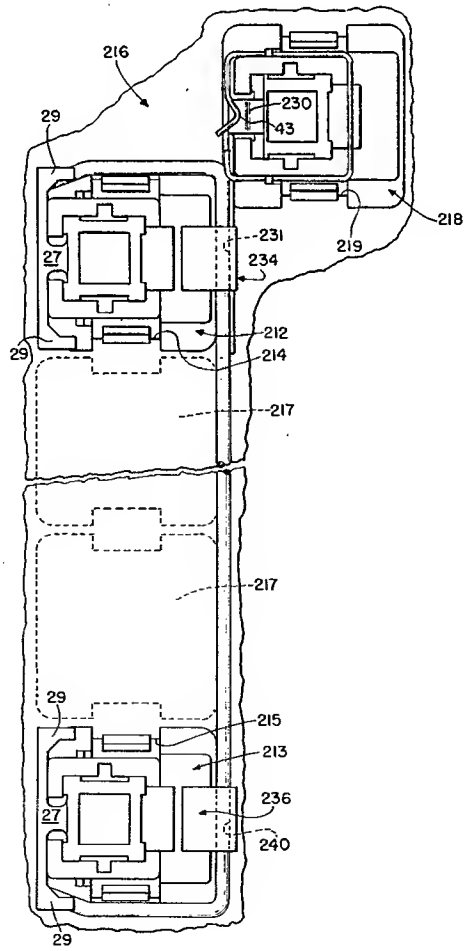


Fig. 1

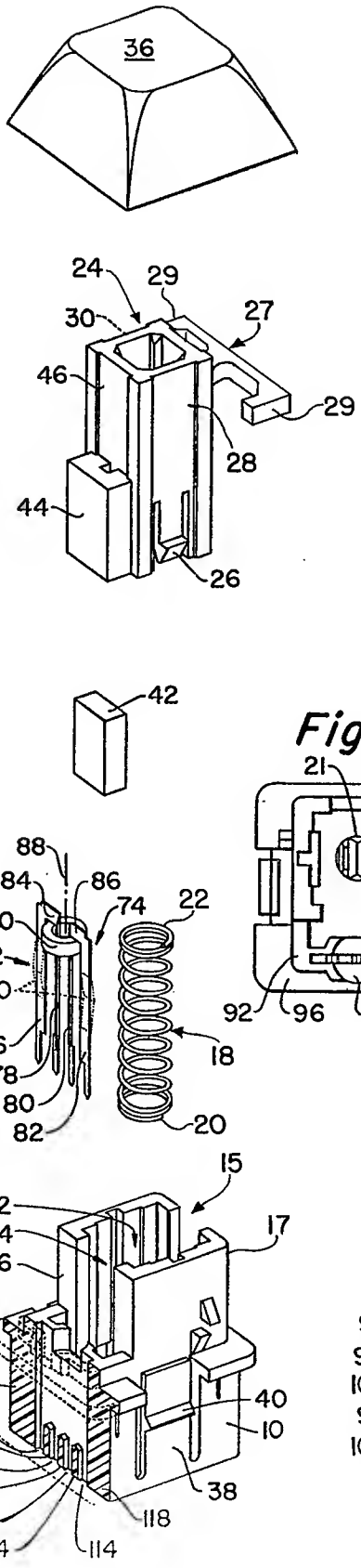


Fig. 3

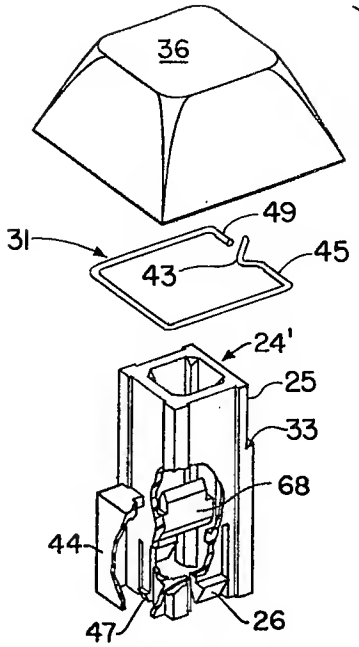
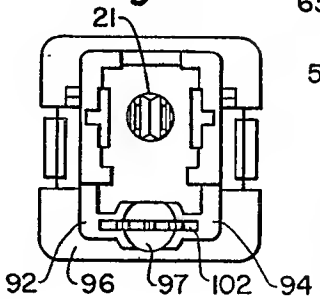
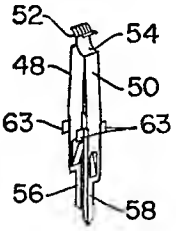
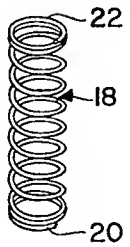


Fig. 2







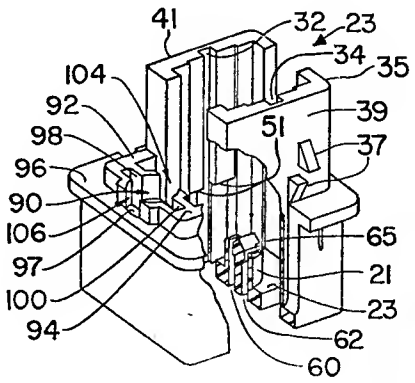


Fig. 4

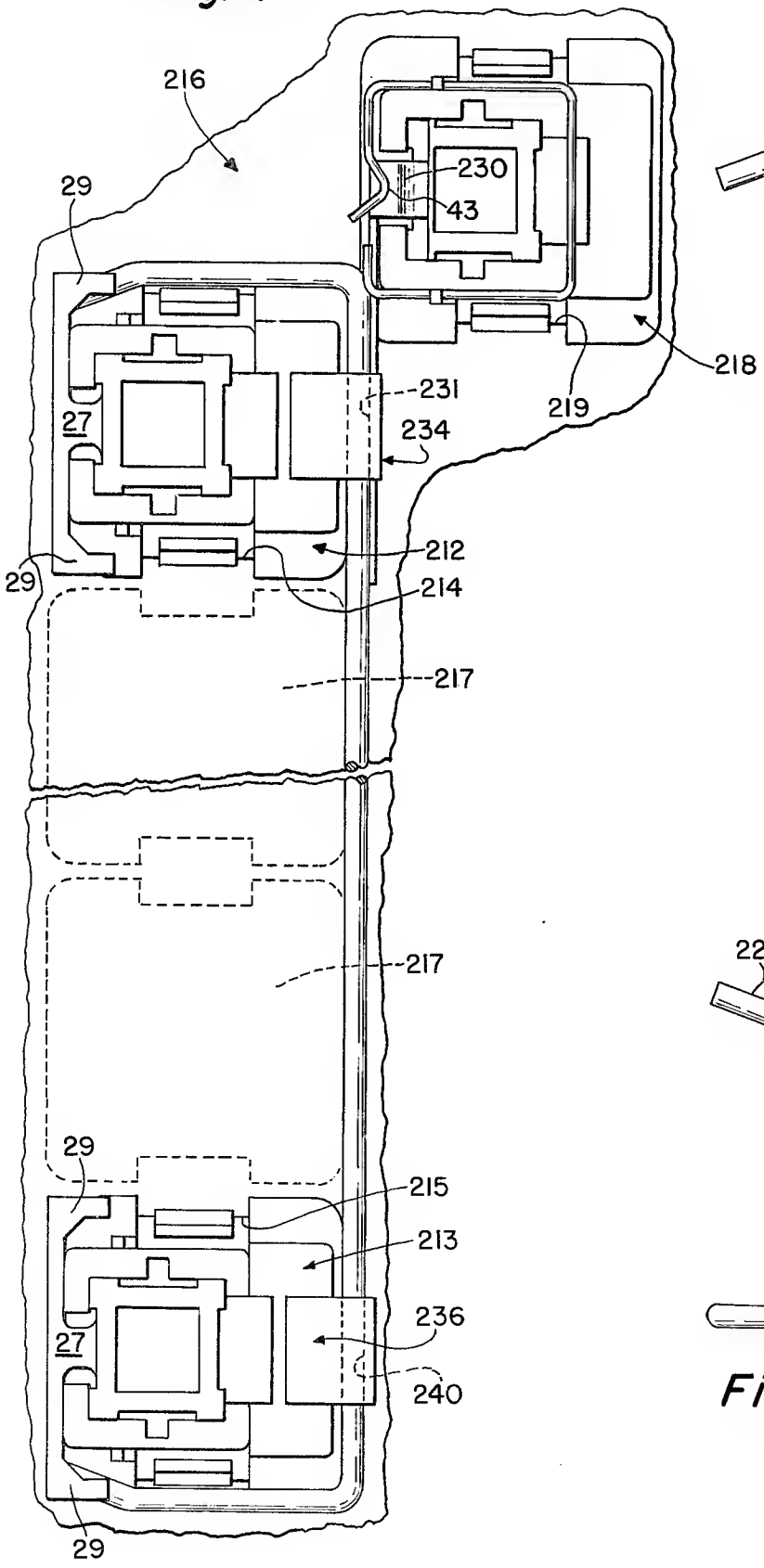
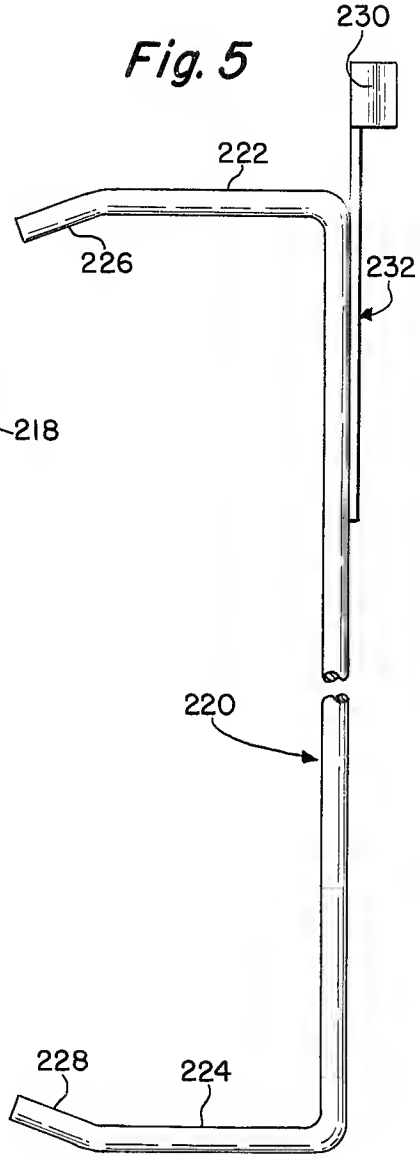


Fig. 5



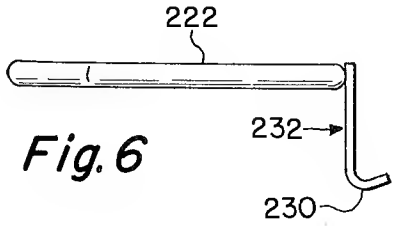


Fig. 6

Fig. 7

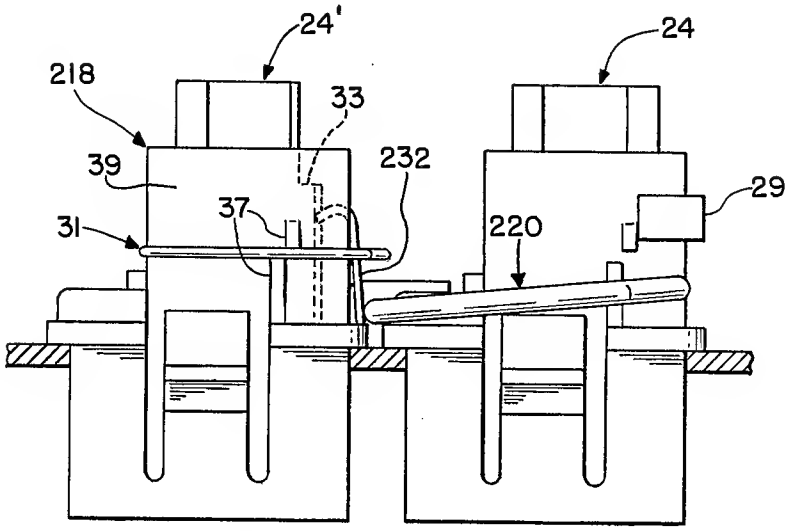
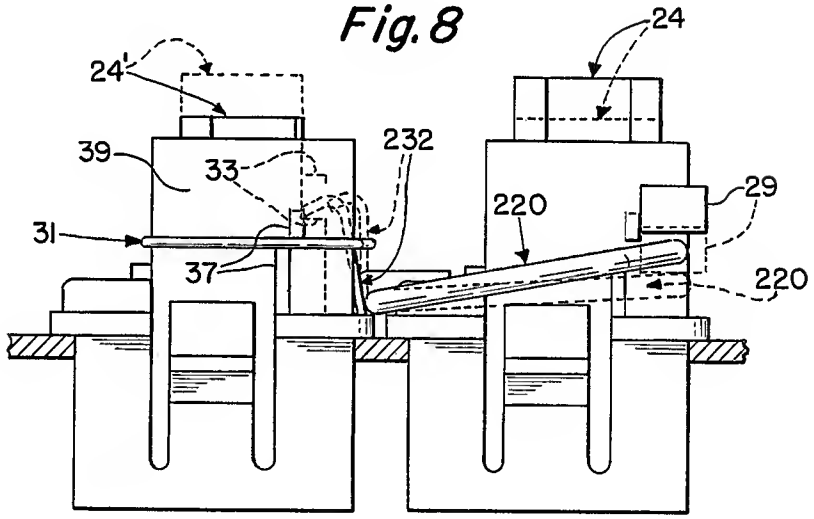


Fig. 8



SECRETARIAL SHIFT MECHANISM FOR AN ELECTRIC KEYBOARD

BACKGROUND OF THE INVENTION

Shift and shift lock and release mechanisms, which are known as secretarial shift mechanisms, are commonly employed on keyboards. The mechanisms are often unduly complex and result in excessive manufacturing and assembly costs. One attempt of reducing the complexity of such keyboards is described in U.S. Pat. No. 4,071,719, which issued Jan. 31, 1978, in the name of Robert Christen Madland and which is assigned to the assignee of the present invention. The keyboard of the Madland patent was a substantial improvement in reducing the complexity of such mechanisms since it required only a single elongated connecting rod between the keyswitches. However, the Madland keyboard did require that the keyboard employ the shift and shift lock keyswitches which required the addition of slideable cam followers on the top of the housing of the keyswitch and which were actuated by a cam that was formed on the plunger of the keyswitch. Thus, while the keyboard of the prior Madland patent substantially reduced the assembly cost of a secretarial shift mechanism, since the cost was essentially the same as the cost of inserting three standard keyswitches into the keyboard, this design still required the manufacture of special keyswitches that were more complex than desired.

The present invention, by contrast, may utilize keyswitches that are basically the same as the other keyswitches of the keyboard, for both the shift and shift lock release functions. In the case of the shift keyswitch it is only required to add a generally T-shaped actuating bar to the plunger of the basic keyswitch of the keyboard. For the shift lock and release keyswitch it is necessary only to add a generally C-shaped retaining spring around the housing of the basic keyswitch of the keyboard. The shift and shift lock and release keyswitches correspond generally to those of U.S. Pat. No. 4,227,163 issued Oct. 7, 1980 in the name of Raymond Barnoski, entitled "Electrical Keyswitch" and assigned to the assignee of the present invention. A pair of retaining wedges support are required on the outer housing of the shift lock and release keyswitch for the wire spring retainer. In addition, slots are required in the housing of the keyswitches of the present invention that are not needed by the switches of U.S. Pat. No. 4,227,163 to allow for the latching finger on the shift lock and release keyswitch (hereafter called the shift lock keyswitch for short) and for movement of the T-shaped actuating bar on the shift keyswitches. However, these features may merely be provided on all keyswitches of the keyboard if desired and the only additional features that would then be required for the shift and shift lock keyswitches are the T-shaped bars and the C-shaped wire spring retainer.

DESCRIPTION OF THE DRAWINGS

The present invention is described by reference to the drawings in which:

FIG. 1 is an exploded perspective view of a keyswitch which may be utilized as a shift keyswitch in the present invention that utilizes magnetic core switching.

FIG. 2 is a bottom view of the switches of FIGS. 1 and 3;

FIG. 3 is a perspective exploded view of a keyswitch which may be utilized in the present invention as the shift lock keyswitch that utilizes mechanical contacts;

FIG. 4 is a partial top view of a keyboard which shows the two shift keyswitches, a shift lock keyswitch and the torsion bar which is utilized to actuate the secretarial shift mechanism;

FIG. 5 is a top view of the torsion release mechanism and the latching finger which is welded to it;

FIG. 6 is a side view of the torsion bar and latching finger of FIG. 5;

FIG. 7 is a side view of a shift lock keyswitch and the adjacent shift keyswitch which illustrates the present invention when the shift and shift lock keyswitch are both in the released state; and

FIG. 8 is a side view of the shift lock keyswitch and the adjacent shift keyswitch which illustrates the operation of the present invention.

TECHNICAL DESCRIPTION OF THE INVENTION

Keyswitches for electrical keyboards may be either of the mechanical contact type or of the analog contactless type, wherein a magnet controls the actuation state of the switch by determining the saturation state of a closed-loop magnetic core that is threaded by drive and sense lines.

The mechanical type of keyswitch has the advantage of being relatively low in cost, and for many applications this factor makes it desirable to employ such a mechanical keyswitch. However, mechanical keyswitches have a number of disadvantages that make them undesirable for use in applications where high reliability is required and the added cost of an analog switch is, therefore, considered to be warranted. These disadvantages include contact bounce, the possibility of arcing, lower life times due to pitting and corrosion and possible deformation of the contact members.

Analog switches, such as the magnetic saturable core, offer greatly reliability, but at a higher cost. In addition, such switches generally require some sort of circuit modification to supply "hysteresis," or a reduced sensitivity of the sensing circuit after a keyswitch has been actuated to prevent electrical noise from producing false output signals. In applications where high reliability is necessary, however, analog switches provide the utmost in dependability and endurance.

It would be desirble for keyboard manufacturers to have the capability of making keyboards with either type of keyswitch, or of even including both types of keyswitches in a single keyboard, in accordance with their customer's wishes. However, previously this has required the manufacture and stocking of two separate types of keyswitches, with added cost and complications.

The electrical keyswitch, described in U.S. Pat. No. 4,227,163 issued Oct. 7, 1980, in the name of Raymond Barnoski and is assigned to the assignee of the present invention, provides a simple electrical keyswitch that is capable of being operated either as an analog magnetic type of contactless keyswitch or as a mechanical type of keyswitch with only minor modifications being necessary to convert from one to the other, due to the improved design provisions that are provided for the keyswitches. In addition, for special applications, both types of keyswitches could be simultaneously incorporated into one keyswitch component if desired; and the present invention is described by reference to FIGS. 1 and

3 wherein the shift keyswitches are described as being analog magnetic core type of switches and the shift lock keyswitch is described as being a mechanical keyswitch. It is understood, of course, that either switch may be either an analog or a mechanical contact type, if desired, as the type of switch employed does not alter the present invention.

One suitable keyswitch for use with the present invention is shown in its analog version in FIG. 1, and in its mechanical version in FIG. 3. FIG. 2 shows a top view of the base of the keyswitch, which is formed of an electrically insulating plastic material. The base **10** of the keyswitch is formed with an integral, hollow, generally rectangular-shaped guide chamber **12** that extends upwardly from the base and has a slot **14** formed in the front side **16** of the chamber. An additional slot **15** that does not appear in the keyswitch of U.S. Pat. No. 4,227,163 is provided in the rear side **17** of the base **10**. A coiled return spring **18** is inserted into the guide chamber **12** with the lower end **20** of the spring receiving the projection **21** that extends upwardly from the bottom surface **23** of the base. The upper end **22** of the spring is inserted into the hollow, generally rectangular-shaped plunger **24** in order to bias it upwardly so as to return it to its initial position after the plunger has been depressed and pressure on the plunger has been released.

The plunger **24** has a pair of resilient looking feet **26** on the opposite sides **28, 30** of the plunger to hold it in the guide chamber **12**. When the feet **26** are pressed inwardly, the plunger is inserted into the guide chamber and then the inward pressure on the feet is released so that they will spring outwardly and engage the ledges **51** in the interior of the guide chamber so as to prevent the plunger from being inadvertently removed from the guide chamber. Two elongated generally rectangular shaped grooves **32, 34**, on opposite interior surfaces of the guide chamber **12**, are provided so that a tool may be inserted into the guide chamber that can depress the feet **26** inwardly when the plunger is to be removed.

A key cap **36** is provided which will indicate the identifying indicia for a particular key and which snaps on the top of the plunger. The base **10** of the keyswitch has a pair of resilient arms **38** on opposite sides of the base. The arms have a projection **40** that allows the keyswitch to be locked into an aperture in a printed circuit board, or other suitable support member, for the keyswitch.

The plunger **24** of the keyswitch is adaptable to provide an analog type of contactless switch when a small magnet **42** is inserted into the container **44** that is carried on the side **46** of the plunger, and held in place by a resilient locking foot **47**. The side **46** of the plunger faces the side **16** of the guide chamber so that as the plunger moves up and down the magnet **42** and container **44** will correspondingly move up and down in the slot **14**. By carrying the magnet on the side **46** of the plunger and by making the plunger hollow, the keyswitch is also adaptable for alternate, or simultaneous, use as a mechanical keyswitch.

The switch of FIG. **1**, which is described as the shift keyswitches, herein, also has an actuator bar **27** secured to the plunger **24**, or integrally formed on the plunger. The bar requires only one of the arms **29**; but to make it useful for both keyswitches, it preferably has a generally T-shaped configuration as shown. The previously mentioned slot **15**, therefore, is provided to allow for motion of a plunger with an actuator bar attached to it.

The mechanical contacts **48, 50** of the switch of FIG. **3**, which is described as the shift lock keyswitch, herein, are of the normally-closed type, and they are formed of two elongated conductive members that have C-shaped contact portions **52, 54** at their upper ends. Each of the contact portions **52, 54** are preferably formed of a multitude of individual contact fingers in order to achieve a high reliability contact. The lower ends **56, 58** of the contacts **48, 50** are reduced in size and project through the slots **60, 62** in the upstanding projection **21**. The contacts also have outwardly projecting wings **63** that fit into corresponding horizontal grooves **65** in the projection **21** to retain the contacts **48, 50** in their proper positions in the switch.

The plunger **24'** is made hollow so that the contact portions **52, 54** of the mechanical contacts extend up into the lower interior portion of the plunger. A separator bar **68**, for separating the normally-closed contacts **48, 50** when the plunger is depressed, is integrally formed across the hollow of the plunger, preferably at a position vertically removed from the bottom of the plunger so as to provide for a low-profile keyswitch, which is desired by many keyboard users. The shift lock switch of FIG. **3** also has a slot **23** cut in the rear side **35** of the switch, which slot did not appear in the keyswitch of U.S. Pat. No. 4,227,163. This switch is further modified by cutting back part of the rear wall **25** of the plunger to form the locking ledge **33**. In addition, a retaining spring **31** of a generally C-shaped configuration is slipped over the base of the keyswitch and is supported by a pair of support wedges **37** on each of the sides **39** and **41**. The spring **31** has an inward bend **43** on the arm **45**, while the arm **49** is straight. The function of the spring **31** and the bend **43** is to retain a locking finger in place in the slot **23** adjacent the rear side **25** of the plunger, as will subsequently be described in more detail.

The analog type of keyswitch illustrated in FIG. **1** utilizes a closed loop, preferably a toroidal-shaped magnetically saturable magnetic core **70**. In this type of switch the magnet **42** is located adjacent the core **70** when the plunger is not depressed. A U-shaped, flat drive line **72** and a U-shaped, flat sense line **74** is threaded through the core so that the sense line may pick up an electromagnetic signal when a pulse of current is supplied through the drive line, providing the core **70** is not magnetically saturated. When the plunger is in its undepressed position, the core **70** will be magnetically saturated and thus pulses of current on the drive line will not produce output signals on the sense line. However, when the plunger is depressed the magnet will move away from the core thereby allowing the core to come out of magnetic saturation so that the drive line signals will now be transformed to the sense line.

Although U-shaped drive and sense lines have previously been used in this type of keyswitch, they were generally formed of round wires and thus previous drive and sense line configurations did not lend themselves readily to automatic manufacture where a large number of such lines could be formed merely by stamping out a single sheet of conductive metal. Such stamped conductors provide for low-cost components that are suitable for automated handling. The drive and sense lines that are formed in this manner each have a pair of parallel straight legs, such as the legs **76, 78, 80** and **82**, and sections between the legs, such as the sections **84, 86**, that are located above the core **70** when the

core is positioned so that its axis **88** is oriented in a vertical direction, as shown in FIG. **1**.

The keyswitch of FIG. **1** is designed to facilitate insertion of the flat drive and sense lines and the core into their final position in the assembled keyswitch. The core **70** is retained in a retaining well **90** which is formed of a pair of upstanding walls **92, 94** that extend vertically from the horizontal surface **96** on the base **10**. When the core **70** is held in the retaining well **90**, the bottom, or lowermost portion of the core rests on the horizontal surface **97** and the top, or uppermost portion, of the core is uncovered and the axis **88** of the core is then vertically oriented. The walls **92, 94** have the grooves **98, 100** respectively formed in them so that the outer legs **76** and **82** of the drive and sense lines, respectively pass through these grooves when the core and the sense lines are inserted into the switch. An elongated slot **102**, as seen in FIG. **2** passes through the surface **97** and extends below the grooves **98, 100** so that all of the legs **76–82** of the drive and sense lines may pass through the slot **102**. The walls **92, 94** are spaced to provide an opening **104** adjacent the side **46** of the plunger so as to reduce the clearance between the core and the magnet. Another opening **106** is provided on the opposite side of the walls to allow for visual inspection of the switch to see if it is carrying a core.

In assembling, the magnetic core **70** may first be inserted from the bottom of the drive and sense lines, to the position shown in FIG. **1**. The drive and sense lines and the core may then be pressed downwardly as a unit so that the legs **76, 78, 80** and **82** pass through the corresponding receiving passageways **108, 110, 112** and **114**, respectively, that are formed in the interior of the base by the outer walls **116, 118** of the base and the three elongated, generally parallel, electrically insulating dividers **120, 122, 124**.

The described retaining and assembly provisions for core **70** and the drive and sense lines **72, 74** allow for easy insertion of these elements into the keyswitch. The passageways provided for the leads are dimensions so that they are tight fitting with respect to the drive and sense lines. The leads, however, may be additionally bent as represented by the dotted lines **130** on the legs **76, 82** if a tighter fit is desired. In such a case, the switches may even be turned upside down without the core and the drive lines dropping out; but they can still be easily removed by pressure on the bottom of the leads. The core and drive line assembly thus may be very easily removed without disassembly of any other part of the keyswitch if replacement of a defective core becomes necessary. This easy removal of defective sensing elements gives the described keyswitch of FIG. **1** a decided advantage over prior analog types of contactless switches.

The mechanism of the present invention may employ one or two shift keyswitches **212, 213**, which may be inserted into corresponding apertures **214, 215** at opposite ends of the keyboard **216**, and a shift lock keyswitch in the aperture **219**. The option of providing a shift release from either of the shift keyswitches is commonly referred to as a "secretarial-shift mechanism" and requires two shift keyswitches. The mechanism could also be utilized, however, with only the shift lock keyswitch **218** and the adjacent shift keyswitch **212**. Besides the keyswitches **212** and **213** there are a number of other apertures **217** which are aligned in a row and which may receive data or function keyswitches therein.

A torsion bar **220**, which is shown in FIG. **5**, extends across the entire keyboard in the preferred two shift keyswitch embodiment shown in FIG. **4**. The torsion bar **220** has a general C-shaped configuration with a pair of inwardly bent arms **222, 224** that extend toward the keyswitches **212** and **213**. The extreme end of the arms **222** and **224** have a more sharply inwardly bent section **226, 228**, and it is this portion of the arm that engages the arms **29** of the actuator bar **27** shown in the keyswitch of FIG. **1**. Though only one arm **29** is required for the keyswitch **212** and the opposite arm **29** is required for the keyswitch **213**, it is preferable that both of the arms be utilized to standardize the construction of the actuator bar **27**, and thus the bar **27** has a general T-shaped configuration.

A locking finger **232** is welded, or secured by other means, to the torsion bar **220**, as shown in FIG. **5**. The finger **232** has a hooked end **230** which engages the ledge **33** of the switch **218**. The bend **43** of the wire retainer spring **31** is forced against the locking finger **232** to hold it into place due to the spring force supplied by the arm **45**. The wire retainer spring **31** is an optional item which may be employed to reduce the resiliency requirements of the locking finger **232**, since it is possible to provide a locking finger with suitable resiliency so that this wire retainer **31** might be eliminated. However, such a locking finger is generally more difficult and costly to make.

The torsion bar **220** is free to rotate, or twist, and is held down only by the plastic clamping caps **234, 236** which are adjacent to the shift keyswitches **212, 213**, respectively. The clamping caps **234, 236** may be separate members which are secured to the frame of the keyboard, but preferably they are formed as a cap which may be fastened to the keyswitch as a cover over the core retaining well **90**. The clamping caps are provided with semi-cylindrical grooves **231, 240** which receive the ends of the torsion bar **220** therein so as to hold the torsion bar **220** down at its end while still allowing it to rotate or twist.

In operation, depression of the plunger **24'** of the shift lock keyswitch **218** causes the hook **230** of the locking finger **232** to engage the ledge **33** thereby holding the plunger **24'** in the depressed positions as shown in FIG. **8**. The depressed state of the keyswitch **218** causes a series of repeating shift signals which continue as long as the plunger **24'** remains depressed.

When it is desired to release the shift lock keyswitch from its depressed condition, either of the shift keyswitches **212** or **213** may be depressed so that one arm **29** of the actuating bar **27** engages one of the ends **226, 228** of the torsion bar **220** causing the bar **220** to twist and the hook **230** to be pulled away from the ledge **33**, as shown in FIG. **8**.

Thus, when the shift keyswitch is depressed the actuator bar **27** engages the ends **226** or **228** of the torsion bar **220** causing it to rotate slightly. This in turn causes the locking hook **230** to pull back so that the hooked end **232** is released from engagement with the ledge **33**, as shown by the dotted lines in FIG. **8**. Once the plunger **24** of a shift keyswitch has been fully depressed, the plunger of the shift lock keyswitch **218** will be driven to its undepressed, or released, position due to the force of the spring **18**, as shown by the dotted lines in FIG. **7**, thereby terminating the repeating shift signal. Subsequent depression of either keyswitch **212** or **213** will then result in a single shift key output pulse. Therefore, the mechanism of the present invention provides a

secretarial shift mechanism for a keyboard in an extremely uncomplicated, yet reliable, manner which requires only very minimal modification of the keyswitches of the keyboard.

What is claimed is:

1. A keyboard mechanism comprising a shift keyswitch and a shift lock keyswitch positioned adjacent said shift keyswitch wherein each of said keyswitches comprises a switching means, a housing with a base for said switching means, an actuating member in the form of a plunger within said housing mounted for movement relative to said housing base from an initial undepressed position to a depressed position for actuating said switching means when said actuating member is in said depressed position, resilient means for returning said actuating member to its undepressed position and wherein said mechanism further comprises a ledge formed on said actuating member of said shift lock keyswitch, locking means which is resiliently biased toward said ledge and which engages said ledge so as to hold said actuating member of said shift lock keyswitch in its depressed position when said actuating member of said shift keyswitch is in its undepressed position, but which does not engage said ledge when said actuating member of said shift lock keyswitch is in its undepressed position and said actuating member of said shift keyswitch is depressed, rotatable release means connected to said locking means and an actuator bar operable exteriorly of said housing and including an arm connected to said actuating member of said shift keyswitch which is constructed to engage said rotatable release means when said actuating member of said shift keyswitch is depressed and said actuating member of said shift lock keyswitch is held in its depressed position in a manner which causes said rotatable release means to rotate sufficiently far to allow said locking means to be withdrawn clear of said ledge which in turn allows said actuating member of said shift lock keyswitch to be returned to its initial undepressed position by said resilient means of said shift lock keyswitch.

2. A keyboard mechanism as claimed in claim 1 wherein resilient biasing of said locking means toward said ledge is applied by a spring wire retainer that encircles said housing base of said shift lock keyswitch with said spring wire retainer being constructed to have two arms, one of which has an inward bend that engages said locking means and resiliently forces it toward said ledge.

3. A keyboard mechanism as claimed in claim 1 wherein said locking means comprises a locking finger that has a hooked end which engages said ledge.

4. A keyboard mechanism as claimed in claim 3 wherein resilient biasing of said locking means toward said ledge is applied by a spring wire retainer that encircles said housing base of said shift lock keyswitch with said spring wire retainer being constructed to have two arms, one of which has an inward bend that engages said locking means and resiliently forces it toward said ledge.

5. A keyboard mechanism comprising a pair of spaced-apart shift keyswitches and a shift lock keyswitch, one of said shift keyswitches being positioned adjacent said shift lock keyswitch, wherein each of said shift and shift lock keyswitches comprises a switching means, a housing base for said switching means, an actuating member mounted for movement relative to said housing base from an initial undepressed position to a depressed position for actuating said switching means when said actuating member is in said depressed position, resilient means for returning said actuating member to its undepressed position and wherein said mechanism further comprises a ledge formed on said actuating member of said shift lock keyswitch, locking means which is resiliently biased toward said ledge and which engages said ledge so as to hold said actuating member of said shift lock keyswitch in its depressed position when both of said actuating members of said shift keyswitches are in their undepressed positions, but which does not engage said ledge when said actuating member of said shift lock keyswitch is in its undepressed position and said actuating member of either of said shift keyswitches is depressed, an elongated torsion bar release means connected to said locking means, a pair of hold-down means each adjacent one of said shift keyswitches which holds down said torsion bar release means while allowing the rotation thereof, and first and second actuator bars each connected to one of said actuating members of said shift keyswitches, said torsion bar release means being constructed to have a bent arm at each end thereof which is adjacent said actuator bar of one of said shift keyswitches, said actuator bars being constructed to engage the adjacent one of said arms when said actuating member of said adjacent shift keyswitches is depressed and said actuating member of said shift lock keyswitch is held in its depressed position in a manner which causes said torsion bar to rotate sufficiently far to allow said locking means to be withdrawn clear of said ledge, which in turn causes said actuating member of said shift lock keyswitch to be returned to its initial undepressed position by said resilient means of said shift lock keyswitch.

6. A keyboard mechanism as claimed in claim 5 wherein resilient biasing of said locking means toward said ledge is applied by a spring wire retainer that encircles said housing base of said shift lock keyswitch with said spring wire retainer being constructed to have two arms, one of which has an inward bend that engages said locking means and resiliently forces it toward said ledge.

7. A keyboard mechanism as claimed in claim 5 wherein said locking means comprises a locking finger that has a hooked end which engages said ledge.

8. A keyboard mechanism as claimed in claim 7 wherein resilient biasing of said locking means toward said ledge is applied by a spring wire retainer that encircles said housing base of said shift lock keyswitch with said spring wire retainer being constructed to have two arms, one of which has an inward bend that engages said locking means and resiliently forces it toward said ledge.

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